Successful Radiofrequency Catheter Ablation of Incessant Ventricular Tachycardia with a Delta Wave-like Beginning of the QRS Complex

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SUMMARY
Ventricular tachycardia with a delta wave-like beginning of the QRS complex is considered to be refractory to endocardial catheter ablation because it originates from the epicardial region. A 45-year-old woman had incessant ventricular tachycardia with a delta wave-like beginning of the QRS complex which was resistant to several antiarrhythmic drugs. The origin of the arrhythmia was at the mitral annulus on the antero-lateral left ventricular wall. The earliest endocardial activation preceded the QRS complex by 18 msec. After 7 sec of endocardial radiofrequency application ventricular tachycardia was terminated. During a 2 year follow-up ventricular tachycardia did not recur and only small numbers of premature ventricular contractions (<100/day) were noted. VT with delta wave-like QRS morphology which originates from the basal region of the ventricle may be treated successfully with radiofrequency catheter ablation using an endocardial approach. (Jpn Heart J 1999; 40: 671–675)

Key words: Ventricular tachycardia, Delta wave-like morphology, Wolff-Parkinson-White syndrome, Radiofrequency catheter ablation, Epicardial origin

Radiofrequency (RF) ablation in ventricular tachycardia (VT) with a slow beginning of the QRS complex has a lower success rate than VT with a fast onset of the QRS complex. 1) One of the major factors for unsuccessful ablation of this type of VT is an epicardial location of the arrhythmic focus. We report a case of incessant VT with a delta wave-like beginning of the QRS complex which was successfully treated with RF catheter ablation using an endocardial approach.

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CASE REPORT

The patient was a 45-year-old woman with an 8-year history of palpitations which were occasionally induced by exercise. With a diagnosis of VT, she was prescribed several medications including mexiletine, disopyramide, pilscainide, aprindine, propafenone, verapamil, and propranolol, all of which failed to prevent her symptoms. She was admitted to our hospital for treatment of her arrhythmia. On admission, her cardiothoracic ratio was 54% and a depressed left ventricular ejection fraction of 46% was noted by echocardiography. An ambulatory Holter ECG revealed incessant VT of 110 to 130/min. Twelve-lead ECG of an episode of the wide QRS tachycardia showed dissociation of P waves and QRS complexes (Figure 1). The morphology of the QRS complexes during tachycardia was positive precordial concordance with an inferior axis and was similar to that of the Wolff-Parkinson-White (WPW) syndrome type A with a delta wave-like beginning of the QRS complex which was negative in leads I and aVL. The ECG suggested her arrhythmia was VT with an origin in the antero-lateral left ventricular base.

The patient underwent an electrophysiological study. Endocardial activation mapping was performed using an ablation catheter (EP Technologies) during VT. Programmed electrical stimulation of the right ventricle could not induce

![Figure 1](image.png)

Figure 1. 12-Lead ECG and a rhythm strip of lead II during VT. A wide QRS complex tachycardia at a rate of 130 beats/min shows positive precordial concordance, an inferior axis, and a QRS complex with a delta wave-like beginning which is negative in leads I, aVR, and aVL. There is dissociation between P waves and QRS complexes. The ECG suggests the arrhythmia is ventricular tachycardia with an origin in the antero-lateral left ventricular base.
Figure 2. Electrophysiological and anatomical characteristics of VT. **A:** Intracardiac electrograms during tachycardia. Note dissociation of atrial and ventricular excitations. The ventricular excitation at the tip of the ablation catheter precedes the QRS complex by 18 msec. Nearly equal amplitudes of the atrial and ventricular excitations suggest that the site was near the mitral annulus. ABL = bipolar recordings of ablation catheter (ABL 1–2 is the tip of the catheter); CS = coronary sinus catheter recording; HBE = His bundle electrogram (HBE 1–2 is the distal and HBE 5–6 is the proximal portion of the catheter); RVA = recording at the apex of the right ventricle. **B:** Catheter position and left ventriculography. The tip of the ablation catheter was located at the mitral annulus on the antero-lateral left ventricular wall. RAO = right anterior oblique view; LAO = left anterior oblique view.
nor terminate VT. The intracardiac electrograms during tachycardia showed dissociation of atrial and ventricular excitations (Figure 2A). The earliest ventricular electrogram preceded the QRS onset by 18 msec. Nearly equal amplitude of the atrial and the ventricular electrograms at the earliest ventricular excitation site during VT suggested that the tip of the catheter was located along the mitral annulus. Left ventriculography revealed the position of the ablation catheter was at the mitral annulus on the antero-lateral left ventricular wall (Figure 2B). RF catheter ablation (55°C, 90 seconds) was performed from the endocardial site. VT was terminated 7 seconds after the delivery of RF energy (Figure 3). During a 2-year follow up VT did not recur and only small numbers of premature ventricular contractions (less than 100/day) were noted.

**DISCUSSION**

This patient had incessant VT with QRS morphology of delta wave-like onset as seen in patients with WPW syndrome type A. An accessory pathway usually attaches to the subepicardial surface of the ventricle. The site of subepicardial origin of VT seems to contribute to formation of the delta wave-like beginning of QRS. This epicardial shift of VT origin makes it difficult to ablate with an endocardial approach. The reason for our successful RF catheter ablation in this patient may be because the VT focus was located in the thinner basal left ventricular wall.

According to Rodriguez et al. 6 out of 48 idiopathic VTs had a delta wave-like beginning of the QRS. Five of them originated from the right ventricular outflow tract and 3 of 5 could not be ablated from the endocardial site. One left-sided VT with a delta wave-like beginning originated from the infero-posterior region. The earliest endocardial activation time during VT was 0 msec and this
VT also was not suppressed by endocardial RF ablation. The success rate for ablation was lower in VTs with a delta wave-like beginning of the QRS (33%) than without it (93%) in their study.

It has been suggested that most VTs in patients with coronary artery disease originate in the subendocardium while a subepicardial origin is a minority in these patients. On the other hand, in patients with idiopathic VT, there are few data that show the incidence of subepicardial origin of VT. As far as we know, this is the first report of successful ablation of left-sided VT with a delta wave morphology.

Epicardial mapping through the coronary sinus may be useful for identification of the site of origin of this type of VT. Stellbrink et al. reported an interesting case of an incessant VT arising from the lateral wall of the left ventricle in a patient without coronary artery disease. Intracardiac mapping suggested an epicardial origin and VT was ablated from a coronary sinus branch. In our case, a 5F-electrode catheter could not reach the VT origin through the coronary sinus. Although the usefulness of transcoronary venous catheter ablation and transthoracic epicardial ablation on VTs of epicardial origin have been described, these approaches may have some associated risks such as injury to the coronary artery or cardiac tamponade. In our case, an incessant VT with a delta wave-like beginning of the QRS complex, which suggested an epicardial origin, was successfully treated with RF catheter ablation using an endocardial approach. In conclusion, endocardial catheter ablation of the basal region of the left ventricle should be considered as the first line of therapy for left-sided VT with a delta wave-like onset of the QRS morphology.

REFERENCES